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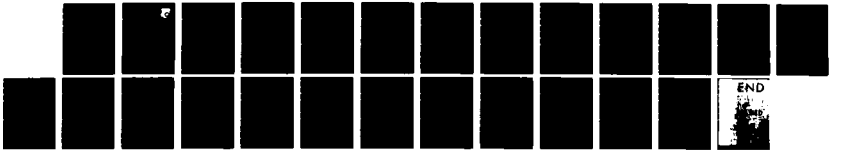

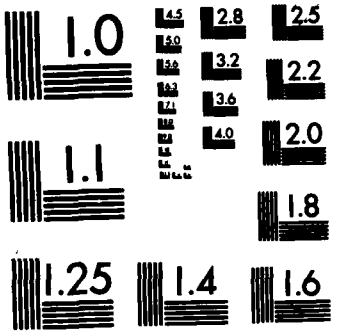

AFWAL-TR-82-2061

COMPUTER OPERATING SYSTEM MAINTENANCE

RAPP SYSTEMS CORPORATION
129 PARK DRIVE
XENIA, OHIO 45385

JUNE 1982

FINAL REPORT FOR PERIOD JULY 1980 TO DECEMBER 1981

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AERO PROPULSION LABORATORY
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This report has been reviewed by the Office of Public Affairs (ASD/PA) and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

With the acquisition of a data analysis system for the Compressor Research Facility (CRF), the Aero Propulsion Laboratory ~~(APL)~~ included an IBM 370 computer system which functions as an integral part of CRF data processing. The IBM 370/155 provides: pre-test database storage and modification facilities; on-line data reduction, analysis and storage; as well as post-test data re-processing. This contractual effort enhanced the 370/155 operating system ~~(OS/MVT RELEASE 21.8f)~~ by providing: Time Share Option modifications, Performance and Usage monitoring, Trade Studies, Share modifications, System Problem

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Identification, Operating System maintenance, Security modifications, Program Product maintenance, and Computer Management Information Facilities. The result of the effort is documented in this final Technical Report.

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SECTION I

INTRODUCTION

During June of 1980, Rapp Systems Corporation began work on a contract with AFWAL/POTX which was to provide maintenance and enhancements to the IBM 370 operating system OS/MVT Release 21.8f. The contract originally outlined 6 tasks for a period of 12 months and was extended to 9 tasks for a period of 15 months.

This report documents some of the activities and accomplishments of that contract. The report is divided into sections, each of which covers a major functional activity or computer system component. Detailed documentation on all of the activities and accomplishments performed by Rapp Systems was delivered to the Air Force during the course of performing the work specified by the contract and is not duplicated within this report.

SECTION II

OS/MVT OPERATING SYSTEM

1. System Generation: The OS/MVT operating system software is tailored to a particular hardware configuration and installation's requirements by a customization process known as systems generation. The multiprogramming with a variable number of tasks (MVT) option was chosen for the Compressor Research Facility (CRF) because it offers the timesharing option (TSO) and has the ability to be re-configured to suit changing requirements on a daily basis with little or no operator intervention. In addition, the software provided by other vendors only operates on this option of the OS operating system. Detailed information about the system generation process and the actual parameters specified for the CRF installation can be found in the COMPRESSOR RESEARCH FACILITY SYSTEM GENERATION MANUAL which was supplied by Rapp Systems on a sub-contract to the CADRE Corporation. Additional information about the system generation parameters and procedures can be found in the IBM Systems Generation manual.

a. The computer at the CRF is an IBM 370 Model 155 with 4 million bytes of main memory, 1 byte multiplexer channel and 4 block multiplexer channels. Mass storage capability is provided by 16 disk drives with 100 million bytes of removable storage each, and 4 tape drives. Additional peripherals include; video display terminals, a card reader

and card punch, a line printer, a communications controller, and a plotter. Two Modcomp mini-computers are attached through 1950 data link controllers.

b. Most of the standard IBM-supplied software components of OS/MVT were generated into the CRF system. In addition, the FORTRAN program products and the TSO utilities program products from IBM and the Full Screen Editor and TSO utilities from Applied Software were installed.

c. The Houston Automatic Spooling Program (HASP) was installed. HASP provides simultaneous peripheral operation online (SPOOLing) facilities which remove these responsibilities from the operator and permit increased utilization of the computer resources. HASP is discussed in detail in subsequent sections of this report.

2. SHARE modifications: The IBM large systems users group, called SHARE, has established a large library of very useful software programs and has made them available to all members of the group. Rapp Systems reviewed this library and selected programs which would be useful to the CRF computer center. These recommendations were documented in a separate report submitted to the CRF. The following programs associated with the operating system were installed:

a. Performance and Computer Usage monitoring facilities were installed to evaluate the computer's performance and to record usage of computer resources for management. The SLACMON program from the SHARE library provides monitoring

and reporting facilities used to evaluate the performance of the operating system itself. An experienced systems programmer uses the information produced by SLACMON to adjust and tune various parameters within the operating system to increase the capacity of the computer to perform useful work. The PROGLOOK program provides a valuable tool for determining which portions of an individual program's code uses the most computer resources. A job can use PROGLOOK to monitor its own program execution, or PROGLOOK can monitor another job. PROGLOOK monitors execution by sampling a program's status at periodic intervals and recording the sampled parameters in an intermediate file. PROGLOOK's post-processor summarizes the collected samples after the run has been completed. The summarized samples are presented in the form of bar charts and tabular reports. By using PROGLOOK, a programmer can reduce the amount of computer resources used by the program. This reduction is accomplished by re-coding those sections which have been identified as heavy resource users.

b. The Display Memory status (D M) operator command was installed. This command provides facilities to display allocated and free memory areas, dataset ownership, major and minor queue control blocks, and the remaining time before a job's execution time limit is reached. It also provides the ability to cancel a job before it has reached the stage of execution when it can be canceled using the normal operator CANCEL command.

c. A device monitor program (MCHK) was installed. This program monitors device interrupts and displays a message when the interrupt does not occur within a specified time. This action notifies the operator of a potential error condition. The operator can manually intervene, if necessary, to correct the problem.

d. The program which prepares a disk pack for use by formatting the data area (IEHDASDR) was modified to speed up the process on 3330 disk packs. The program which prints the hardware error log (LOGREC) was modified to use modules from IBM's virtual operating systems. This change increased the features available from the program and simplified the resultant reports to better fit the multi-vendor environment at the CRF computer center.

e. SHARE has collected a useful library of FORTRAN callable subroutines which have been documented and installed in the FORTRAN library at the CRF. These library subroutines are easy to use and expand the capabilities of the computer when programming in the FORTRAN language.

3. Program product installations: The IBM FORTRAN G1 compiler and library program products were installed per installation instructions supplied with the product. The library was updated in September of 1981 and the SHARE subroutines were added The TSO utilities were installed. Problems were encountered when the Full Screen Editor (FSE) and the TSO superset utilities supplied by

Applied Software, Inc. were installed. These installation problems were corrected with phone help from ASI.

4. Miscellaneous Activities: A technical newsletter was published which provided a forum to keep CRF personnel informed about such things as new software, software problems, and other information about the computer system which might be useful to the users of the CRF computer. A System Software Trouble Log was introduced. The trouble log provided a media for reporting problems and provided a systematic procedure for problem determination and resolution. The trouble log form contains fields for problem description, severity, priority, and action taken to circumvent the problem.

Several major problems were resolved by Rapp Systems personnel which were of significant interest to be mentioned here. A problem with the interface between the Modcomp mini-computers and the IBM computer was traced to a software bug within the 1950 device driver on the Modcomp mini-computers. Problem determination efforts were fruitless until Rapp Systems personnel isolated the problem to a timing condition when the 1950 driver responded with controller busy condition and then never cleared this condition. The OS nucleus assumed the busy condition would only last a fraction of a second, and therefore looped until the Modcomp cleared the condition. A re-occurring WAIT state within the CRF control software provided by P & W was

diagnosed by Rapp Systems to be a logic control bug within the Master Control Program (MCP) of the P & W supplied software.

SECTION III

HASP SPOOLING PROCESSOR

HASP is a specialized program which operates in the same computer with the OS/MVT operating system and performs the peripheral functions associated with batch processing. HASP assumes control of all on-line unit record devices and controls all data transfers between them and other processes within the computer. HASP appears as a compatible extension to the MVT operating system and provides specialized supplementary support in the areas of job management, data management, and task management. HASP acts as a transparent "front-end" processor and performs as an automatic scheduler and operator of the operating system. Because of this relationship between HASP and the operating system, various functional, performance and operational benefits can be included in HASP. In addition, local system enhancements can be added to the HASP system without disturbing the operating system itself.

1. HASP Generation. The HASP system software is tailored to a software-hardware configuration and installations requirements by a customization process known as HASPGEN. The orginal HASPGEN was done before the time period of this report. The parameters selected at that time permitted 7 simultaneous jobs with no remote work stations. A subsequent

HASPGEN was done to add a SHARE modification which separated various messages in the job control log of each job so that important messages started in the left margin. Other messages were indented 5 or 10 spaces depending on the importance of the message.

Early in 1982 a complete HASP generation was performed. This HASPGEN was done in order to add additional facilities, and to add remote job entry (RJE) terminal support.

a. The job classes of the 7 initiators were changed to improve control over computer resource utilization. Four initiators were assigned to job classes ABCD, all with equal priority. Classes ABCD are to be used for general purpose batch jobs. The fifth initiator was assigned a job class of E with a higher default priority. Class E is used for jobs which must be completed in a short period or which require immediate response to external events. The compressor testing system is a good example of a class E job. Class F jobs are run in the sixth initiator which has a low priority. Class F jobs are characterized as using a large amount of computer time. By running them at a low priority, they use only the excess computer time and do not impact the operation of the other jobs within the system. The seventh initiator is assigned class G with a priority between the class E initiator and the ABCD initiators. Class G is a general purpose initiator which is used mainly by the systems operation group. Only classes ABCD and F participate in the HASP dynamic scheduling feature.

b. The operating system divides output into 36 classes identified by a class identifier (A-Z,0-9). Each class can be designated as either HASP printed output, HASP punched output, or OS processed output. At the CRF we use the output class to determine the type and destination of the output. Three output destinations are available to the user. They are: HASP, OS spooling, and TCAM message queues.

HASP output has two forms, printed output and punched output. Printed output is specified by using SYSOUT=A on the DD statement or by using an output class which is changed by HASP to class A. Punched output is specified by using SYSOUT=B on the DD statement.

OS spooling is used for datasets which require special processing or are to be accessed via a TSO terminal. Datasets which are going to be automatically routed to a TCAM message queue must use OS spooling when they are first created.

A TSO user's output class defaults to class X. In addition, class T can be used to permit the TSO user to have access to the JCL printout of batch jobs.

Special forms requests are designated by placing a forms designator in the third positional parameter of the SYSOUT= keyword on the DD statement, eg. SYSOUT=(J,,form). HASP output class J should be used on all jobs which are printed locally and use special forms. HASP output class K should be used for special forms punched output.

TSO accesses datasets with an output class of X by

default. The JCL of a batch job can be reviewed from a TSO terminal by assigning the message class for the job to MSGCLASS=T. When the job finishes execution, HASP requeues the system message block (which contains the JCL) into class X. OS output class Y is also requeued to class X by HASP. This class can be used for special applications which need to make output available to TSO.

The following chart shows the 36 output classes and their characteristics:

CLASS	HASP	OS	REMARKS
A	A	-	NORMAL PRINTED OUTPUT
B	B	-	NORMAL PUNCHED OUTPUT
C	A	-	
D	A	-	
E	A	-	
F	A	-	
G	A	-	
H	A	-	
I	A	-	
J	A	-	SPECIAL FORMS PRINTED OUTPUT
K	B	-	SPECIAL FORMS PUNCHED OUTPUT
L	A	-	
M	*	M	GENERAL USE
N	*	N	GENERAL USE
O	A	-	
P	*	P	PLOTTER OUTPUT
Q	A	-	
R	A	-	
S	A	-	
T	A	X	JCL REQUEUED TO OS CLASS X
U	A	-	
V	A	-	
W	A	-	
X	*	X	TSO DEFAULT OUTPUT
Y	*	X	REQUEUED TO X AT END-OF-JOB
Z	*	O	OS OUTPUT TO BE PRINTED BY HASP
0	A	-	
1	*	1	ROUTED TO TCAM MESSAGE QUEUE
2	*	2	ROUTED TO TCAM
3	*	3	ROUTED TO TCAM
4	*	4	ROUTED TO TCAM
5	*	5	ROUTED TO TCAM
6	*	6	ROUTED TO TCAM
7	*	7	ROUTED TO TCAM
8	*	8	ROUTED TO TCAM
9	A	-	

NOTE: An asterisk in the HASP column indicates that OS

spooling will be used for this class.

c. Remote Job Entry capability was added to support both direct and dial-up access to the CRF computer. Four RJE communication lines and twenty remote workstations were defined. Support for simple and multi-leaving terminals was generated. Selection of the terminal type is accomplished when the terminal signs on to the computer. The terminal's assigned remote number also defines the terminal type.

d. A customized output separator page was added to the HASP system. The new separator contains additional information about the job which helps the operator route the job's output. In addition, the size of the account number field of the job statement was increased to conform with the account number standards at the CRF.

SECTION IV

TIME SHARING OPTION

TSO is the time-sharing option of the OS/MVT operating system. TSO permits a number of computer users to use the facilities of the CRF computer concurrently and in an interactive, conversational manner. Requests are typed on the keyboard of terminals which are attached to the computer system by local or remote communication facilities. The system responds to user requests by performing the work and sending messages back to the terminal. The commands and subcommands recognized by TSO form the TSO command language. Additional commands and subcommands have been added to the standard IBM-supplied command language.

TSO generation consists of specifying TSO parameters in the systems generation process and generating a TCAM message control program which supports TSO. The system generation parameters are described in the CRF Systems Generation manual and the message control program is described in the TCAM section of this report.

1. Command Language Enhancements. A command library, available to all users, was installed to catalog and store general purpose command procedures called CLISTs. In addition, the following commands were added to the standard TSO command language and the TSO help data set was updated

to include these commands:

a. The data set status command (DSAT) is used to display allocation information for data sets on direct access devices. DSAT can be used from a terminal or from a command procedure. The DSAT command provides a comprehensive list of operands which can be used to control the information display.

b. The Compress command (COMPRESS) is used to recover the unused space in a partitioned data set. This command can be executed from a TSO terminal. Compression of the data set occurs inplace.

c. The partitioned data set utility command (PDS) provides a variety of subcommands which simplify operations on members of a partitioned data set.

d. The FREEALL command performs the FREE operation on all temporary data sets allocated to the terminal user.

e. The CFREE command is identical to the standard FREE command except that the error message 'DATA SET NOT FREED, IS NOT ALLOCATED' does not appear when that condition exists.

f. The TPRINT command permits the user to display a message from inside a command procedure.

g. The LISTPROF command allows the user to display his current terminal profile.

h. The WHOGOT command identifies the current ownership of the data set identified by the command's operand.

i. A set of command procedures were added to the command

procedure library which configure TSO to operate with several terminal types. These command procedures use the TERMINAL and PROFILE commands to accomplish this configuration and are executed by entering a simple command after logging on to TSO.

2. TSO Customizations. The TCAM message control program module was modified to permit the transmission of terminal control characters from a TSO program. This modification is described in the DISSPLA installation instructions and is further documented in the TCAM section of this report. In addition, the message termination codes within the 1270 Transmission Control Unit were changed to include the carrier return (CR) code. This modification permits one character termination of a terminal user-entered message and simplifies terminal operation on those communications lines which are connected through the 1270 TCU.

SECTION V

TCAM MESSAGE CONTROL PROGRAM

The Telecommunications Access Method (TCAM) is a generalized I/O control system that extends the techniques of data management to the teleprocessing environment. TCAM provides a Message Control Program that manages the teleprocessing network and controls the flow of data to and from remote terminals and TSO and other application programs. Message handlers attached to the message control program direct and supervise the transmission of data to and from the network. TSO requires a special message handler which can be generated using standard macros provided with the IBM operating system. Other applications require a message handler tailored to each application's requirements.

a. The TSO message handler was generated to include local 3270 video display terminals and TTY-type remote terminals. The second stage of the TCAM MCP generation was modified per Applied Software's instructions to permit operation of their Full Screen Editor (FSE) under control of the TSO message handler. This modification adds additional macro instructions to the TSO message handler to support 3270 terminals in full screen mode.

b. Early in 1982, the message control program was expanded to include message handlers to support output to word processing printers and a Hewlett-Packard multi-colored pen plotter. These message handlers use disk queueing which

permits long messages to be stored for a period of time when the destination terminal is disconnected or busy. These re-useable disk queues permit a limited spooling capability.

c. The TCAM message control program module IEDAYE was modified to permit terminal control characters to be transmitted to and from a TSO program. This modification changes two branch instructions within the IEDAYE module. The modification circumvents translation of control characters to colons and is described in the installation instructions of the DISSPLA software product supplied by ISSCO.

SECTION VI

COMPUTER MANAGEMENT INFORMATION FACILITY

The Computer Management Information Facility (CMIF) system was developed by Rapp Systems to fulfill the need at the CRF to record and report on computer center resource usage and utilization. The foundation of the CMIF system is a System 2000 data base (CRFMGMT) which stores and permits access to data generated by the operating system's System Management Facility (SMF). Programs were developed to load the SMF data into the data base and produce reports and plots. The plot program produces plots on the Gould plotter showing the relationship between system performance and system utilization at selected time periods.

a. The report programs display usage of the computer resources divided into 14 different reports which accommodate usage statistics, user profiles, tape assignments, and system software documentation. Reports and plots are produced using selection statements which permit reporting based on user identification, account number, or both. In addition, all reports and plots can be specified using a time range as part of the selection criteria.

Rapp Systems designed the data base schema, developed routines and procedures to load and modify the data base, developed routines and procedures to generate reports and plots from the data base and performed the functions of a data base administrator.

SECTION VII

CONCLUSIONS AND RECOMMENDATIONS

The tasks included in the contract have greatly enhanced the IBM 370 performance at the CRF. Some of the tasks involved reporting the results of study activities and will require additional work as a result of these trade studies. Some of the tasks involved timely analysis and diagnosis during maintenance and went beyond the contract intent in areas of other contractor responsibilities. Because of the future efforts which will take place in continually enhancing the system at the CRF, and because of the migration plans to a virtual environment, Rapp Systems recommends that no additional funds be expended to upgrade the existing software-hardware configuration. We further recommend that all efforts be directed towards the acquisition of new computer hardware which will support a virtual operating system. The compressor testing software could then be upgraded to operate on this new configuration. Additional capabilities could be added during the upgrade process and the final result would be a computer system which could support the CRF for many years to come.

Long range plans for the facility need to be formulated and made known so that Rapp Systems can compare CRF goals with their qualifications and respond accordingly.

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